



## Achieving flood resilience through improvements at building fabric/layout level

Manuela Escarameia (1) and Andrew Tagg (2)

(1) HR Wallingford, Howbery Park, Wallingford, Oxfordshire OX10 8BA, United Kingdom  
(m.escarameia@hrwallingford.co.uk), (2) HR Wallingford, Howbery Park, Wallingford, Oxfordshire OX10 8BA, United Kingdom (a.tagg@hrwallingford.co.uk)

The specification of flood resilient building construction has become increasingly appealing as a complementary measure to the formal flood protection schemes provided by municipalities and the various flood protection products that can be deployed at property level. Resilience at property level can be achieved by the judicious use of construction materials and methods of construction, combined with careful site considerations to reduce exposure to floodwater or minimise its impact.

This paper provides a review (developed under the current EC FP7 project FloodProbe) of flood resilient construction materials, regulations and practices available in a range of countries including the UK, Germany, Poland, USA and Australia. It was aimed specifically at critical buildings but can be extended to any urban type. Critical buildings have been defined as buildings where essential services are housed and which, should they be affected by flooding, would severely disrupt the running of urban societies.

Construction materials have been categorised in this review according to a revised, more detailed version of the classification used by the US Federal Emergency Management Agency (FEMA); this classification includes structural materials (e.g. those providing structural support or rigidity to a building or building component), finish materials (e.g. wall and floor coverings, partitions), insulating materials and apertures (doors, windows).

Although a number of countries have guidelines on urban flood resilience that include building materials, most classification systems rate the materials in a qualitative manner and it is not always clear what the basis for the rating is. It was found that the USA has been leading the world in the specification of construction materials with guidance documents rating building materials according to their ability to resist flood water dating back to 15 years ago. On the other hand, the UK has provided some pioneering work on the testing of materials under laboratory conditions that are quite a realistic approximation of the pressures such materials and building components are subjected to in flood situations. However, regulation has not yet caught up with technical developments.

With regard to construction practices, the Netherlands is the country investigated that appears to focus most on innovative construction layouts as a means of reducing flood risk (e.g. floating houses); these approaches are more appropriate for new developments and require considerable engagement and "buy-in" at the planning stage, which is not likely in many countries.

A number of knowledge gaps were identified as a result of this study: 1. The adequate choice of building materials can be an effective means of minimising the impact of floods but currently there is no regulation at European (or at national) level; 2. No approved testing protocols are available at European level that correctly simulate the general conditions that buildings components are subjected to during flooding; 3. Limited testing has been carried out on building materials and there is a need to understand the behaviour of a wider range of materials, wall and floor components, insulation and apertures; 4. Examples of actual application of resilient and resistant materials either for new buildings or retrofits are very limited and are mainly confined to basements.